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LESSONS I HAVE LEARNED IN THREE DECADES OF WORKING WITH TEACHERS ABOUT GIRLS IN STEM

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This is a retrospective reflection. Having worked with STEM (National Science Foundation lingo for science, technology, engineering, and mathematics) and education teachers, primarily at the secondary and postsecondary levels, since the 1980s, I discuss some of the major lessons I have learned, namely, the evolution of teaching gender equity in the past thirty years, where we are now, why educators resist gender equity, what we still do not know about gender equity in education, what seems to work to reach teachers, and how to increase our progress.

KEY WORDS: *STEM education, teachers, resistance, strategies for success, gender*

1. INTRODUCTION

In the late 1970s and early 1980s, Sylvia Kramer was a visionary fifth grade teacher and the Title IX compliance officer for the Great Neck Public Schools on Long Island, New York. Great Neck was, and is, an upper-income community, and as such was one of the first school districts in the country to buy computers for its students.

As a feminist, Sylvia noticed something other teachers did not, namely, nearly always it was the boys who took advantage of the opportunity to use the Commodore PET computers, the TRS-80 computers, and the Apple II computers. (Remember those? Remember how the 64K Apple IIe in 1983 was a marvel of progress?) When she became the executive director of the Women's Action Alliance in New York, she immediately wrote a proposal about sex bias, as we called it then, in children's computer use to the Women's Educational Equity Act Program in what was then the Department of Health, Education, and Welfare (DHEW). They funded it. She started looking for someone to run it.

At the time Sylvia was still teaching in Great Neck, I was directing my first nationwide gender project, which started in 1979. It dealt with women in nontraditional occupations, and was also funded by DHEW. It was obvious by then that the future for women who wanted to gain the advantages of predominantly male jobs lay in the technologies, not in the construction trades. When Sylvia interviewed me for her new project, computer equity for girls seemed to me quite similar to nontraditional occupations for women—just younger. She hired me in 1983 to direct the new Computer

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Equity Training Project, and I became the first person in the United States (and for all I know, the world) to direct a project concerned with girls and computers.

In the years since then, I have had occasion to carry out many more projects, many of them nationwide and multiyear, dealing with girls, teachers, and STEM—those that addressed technology specifically, others that focused on science, and some that dealt with both areas. I have worked with teachers from elementary school through postsecondary education, parents, administrators, and girls themselves.

2. THE HISTORICAL TRAJECTORY OF THE COMPUTER EQUITY ISSUE

When I started doing gender equity work in computers in the early to mid-1980s, the typical reaction from the few teachers and administrators who at that time had computers for student use was that there was no problem because there was no computer gender gap. When I visited schools, it quickly became apparent to me that educators simply did not notice it. I remember touring a middle school in the Midwest with a principal who was proud to show me around his beautiful new building, set up with clusters of two or three computers in various places. The first cluster we came to was unoccupied. The second had one boy. The third had two boys. The fourth had three boys. Finally, we saw a girl and two empty computers at a fifth cluster. The principal turned to me and said, "Well, I'll be damned. I had no idea!"

I came to expect the "Well, I'll be damned" realization. Unfortunately, it was usually followed by the observation that the preponderance of boys at the computers did not matter, because boys were "naturally" more interested in computers than girls. So, we were back to "no problem."

By the early 1990s, things were somewhat different. By then, there had been some articles in the professional and public media, but teachers repeatedly assured me that in their schools things were different. "The girls here use computers a lot!" When I looked more closely, however, it turned out they were talking about girls in keyboarding classes, data entry classes, or word processing classes—basically, computing for the future secretaries of America.

In the late 1990s, we got past clerical computing when educators triumphantly pointed to girls' use of multimedia on the computer and how girls loved e-mailing. Girls were also enthusiastic about the Internet. In other words, the traditionally female interests of art and socializing enabled educators to claim the nonexistence of a computer gender gap. They did not notice that the increasingly prevalent programming courses enrolled mostly boys. A well-intentioned teacher once sincerely asked me why it was important that girls take programming. Good question, actually. I answered it by asking him about the value for boys of taking programming. When he was able to answer my question—he answered his own.

The second half of the 1990s was also the time I started to hear a new variation on the theme. By then, due perhaps to continuing articles in newspapers and the professional press as well as conference presentations, there was general recognition among educators that in fact a computer gender gap was real, it mattered, and it was in their own schools. We computer equity specialists had finally succeeded, right? Wrong.

Now what I heard was, "Well, you're right. There really is a computer gender gap and I see that it matters. But we have so many other initiatives going on this year that we have no time for anything else. Maybe we can get to computer equity next year." So, computer equity took its place at the end of the line, far behind the need for a new roof and uniforms for the football team.

Now, we are nearly through still another decade, and, honestly, I find the main excuse of this decade even harder to deal with than the earlier ones. The story I am hearing now from educators goes like this. "Gender equity in computing? In science? What are you talking about? We solved all those gender equity problems in the 80s and 90s. Why do you feminists keep complaining about the same old thing?" I am not the only one to have heard that. In a recent book by Sadker, Sadker, and Zittleman (2009), the first chapter is entitled, "Didn't We Solve this Problem Years Ago?". A recent variation on the theme is heard perhaps just as often—"You feminists keep complaining about the same old thing, but OUR problem is the boys!" Most recently, of course, the budget cuts in many programs and districts also prevent action on gender equity as well as many other pressing educational dilemmas.

This means that to make any headway, I must first convince skeptical educators that there is still a gender problem that deserves attention despite real progress for girls and women in STEM areas. I also have to convince them that boys' undeniable educational problems do not negate those of girls.

Many educators do not seem to notice that the healthy presence of girls at lower levels of computing and science in schools does not continue at the upper levels. In 2008, for example, girls were only 18.6% of the students who took the advanced placement exam for the one-semester computer science course (CS-A), and just 12.8% of those who took the one-year course (CS-AB). In fact, an average of only twelve girls per state took the CS-AB exam. This is the lowest female participation in all 37 AP exams offered. Physics is better, but far from good enough; in 2008, girls were 34.9% of those who took the physics B AP exam, 23.8% of those who took the physics C electricity and magnetism exam, and 26.9% of those who took the physics C mechanics exam. These participation rates do not bode well for our future. (College Entrance Examination Board, 2009)

In a national survey of nearly 400,000 college freshmen carried out every fall, students are asked to rate themselves on a variety of skills and characteristics. An issue on which male and female students diverge highly is computer skills; more than 17% percent more young men than young women rated their skills as above average (Hoover, 2008). This compares to other skill areas such as writing and public speaking, where the point spreads were under 10%.

Educators do not seem to make enough of a distinction between using technology and science versus creating it for the rest of us to use. They are not coming to grips, apparently, with the fact that technology and science are now the major gateway to technical careers, replacing math in that role a generation earlier, and that technical careers are more central in our economy and national life than ever before.

3. WHERE WE ARE NOW

Almost 25 years ago, Eunice Okeke, a Nigerian science educator and gender equity specialist, taught me that the three requirements for gender equity progress were awareness, concern, and action—recognition of a gender imbalance, belief that the imbalance matters, and doing something to change it. The absence of any one of these prevents progress.

She was right, but based on what I have seen, I would say it differently now. To achieve gender equity in STEM (or in any sphere for any underrepresented group), one must have the following:

- Knowledge
- Resources
- Resolve

In other words, one must know about the problem, have the resources to address it, and be determined to do so.

I propose this way of looking at the STEM gender gap because it highlights a different situation now. First, by now, we have a great deal of knowledge. There have been several decades of research, studies, programs, and projects, which collectively have yielded a substantial body of knowledge about what works and what does not. It has been published in print and is increasingly posted on the Internet, and is therefore available to anyone who wants it.

For example, the book, *New Formulas for America's Workforce: Girls in Science and Engineering*, showcases what has been learned from over 200 projects funded by the Research on Gender in Science and Engineering Program at the National Science Foundation (National Science Foundation, 2003). Eighty-seven projects are listed under the entry "teacher training" alone. There are hundreds of others resources as well, including my own research review on gender and technology in education (Sanders, 2005). Searching on "gender equity in schools" in Google now gets you well over a million Web site listings.

Second, we have learned that, by and large, expensive resources are not required to correct gender inequities in STEM. We do not need huge salaries or elaborate laboratories or expensive materials. What we do need is training to impart the knowledge, which costs a little, time for the teachers to learn, which also costs a little, and administrative support, which costs nothing. Gender equity is just not very expensive to achieve.

This leaves resolve, which in fact seems to be the key missing element. I see it at the preservice level in teacher education programs, where gender is now without a doubt the invisible social justice issue. Teacher education frequently addresses multicultural concerns and disability issues, and increasingly, socioeconomic issues as well, but gender is typically nowhere to be found unless it happens to be a personal interest of the professor. In a survey that Pat Campbell and I conducted in the late 1990s, we found gender to be woefully uncovered in teacher education programs (Campbell & Sanders, 1997). The least covered gender equity topic of all was Title IX, the federal law that mandates gender fairness in schools receiving public funds.

In 2004, teacher education participants in my Washington State Gender Equity Project and I were instrumental in getting the state requirements for teacher and administra-

tor certification amended to include gender. As far as I know, Washington State is the only state in the United States to have strong gender requirements for new teachers' and administrators' certifications, but I cannot say for sure that the letter of the law is being followed at all teacher preparation programs around the state.

Resolve also matters at the in-service level, with teachers and administrators. This is partly an issue of leadership at the district and building levels, i.e., gender equity fares better with superintendents and principals who consider it important. They can make in-service training possible, can send teachers for training, and can provide incentives and disincentives for teachers and counselors commensurate with the extent of their gender equity progress. Resolve matters individually as well, i.e., teachers choose articles to read in professional magazines and they choose conference sessions to attend. Many of them also choose professional development summer programs as well.

If I am correct—if in fact the slow progress of gender equity in STEM is not due to a lack of knowledge nor to a lack of resources, but rather to a lack of resolve—then to make more progress, this is what we have to address. With it, teachers will obtain the knowledge and the few resources they need. We must move gender equity in STEM from its vague place far in the background of educators' professional consciousness to prominence as an issue that educators want to deal with.

4. WHY EDUCATORS RESIST GENDER EQUITY IN STEM

I am convinced that the inadequate gender equity progress we have seen, especially in technology, is due to a number of quite natural, quite human, quite understandable reasons. First and perhaps foremost, teachers believe that because they are not intentionally discriminatory—and the overwhelming majority of teachers are not—they think that the gender imbalance cannot be helped. They wish it were otherwise, and they often try to encourage girls to continue to the next level up. When their efforts do not bear much fruit, they tend to be resigned to the status quo. This is what Valian (1998) means when she speaks of the inadequacy of good intentions. It is also what my colleague Tom Kibler calls the "pure of heart" model—if one means well, then that is sufficient. Well, it is not. Teachers sincerely believe that because they consciously mean no harm, they cause none. They have no idea that differences in treatment of students are usually below the level of conscious awareness, and they certainly have no idea of the cumulative power of these small differences.

Sometimes, teachers resist gender equity efforts because they see them as discriminatory. Fairness, to them, means being even-handed or treating everyone "the same." Since they fail to realize that they often are not in fact treating males and females the same, they tend to see gender equity as favoring girls at the expense of boys. An even more subtle problem is that they have a hard time understanding that being even-handed when conditions are not equal is hardly equitable. Girls who are unsure of their technical or scientific abilities are not, in important ways, equal to boys who are sure of theirs. It is like calling a race fair because the start and finish lines are the same, but ignoring the fact that the runners consist of marathon winners as well as neighborhood joggers.

Books and articles published in recent years about gender equity for boys, important as that is, have had the unfortunate effect of framing the gender issue as "either/or." It is true that there are many gender issues for boys, and education would undoubtedly be better off if they were dealt with. An either/or mind-set pits victim against victim. Who suffers more? The notion that both do, differently, seems not to occur to many teachers.

Some teachers do make progress on recruiting and retaining girls in STEM classes, and that brings up another problem. If a teacher manages to go from 10% girls to 20% girls in her or his class, she or he is justifiably delighted. But progress can be confused with success, so the doubling in the number of girls gets more notice than the paltry 2:8 enrollment ratio.

Sometimes, a teacher will have success with one or two girls, meaning that the teacher succeeds in getting these girls to take higher-level courses, or the girls go on to major in a technical area in college. These results feel good, and teachers do not recognize them as exceptions to the more general rule of girls not advancing to higher-level courses and not majoring in STEM. As my colleague Pat Campbell puts it, they think the plural of anecdote is evidence.

The sex of the teacher can have a negative impact on gender progress in STEM, but perhaps not in the way you would think. It relates to the way that people who do not understand how gender bias really operates conceive of its cause. They think that male teachers are a priori guilty and female teachers are innocent. I have often seen that female teachers tend to think they are exempt from concerns about gender bias because of their femaleness. Male teachers often think that because they are men, there is nothing they can do to make a constructive difference. Neither is true—men and women are equally sexist, in my experience—and in the meantime, the gender imbalance continues.

One thing that hinders progress is that many teachers see gender equity as a sideline to their real work of teaching their subject. Partly because teaching is of course a full-time job—particularly in large cities where five or even six classes a day, sometimes with different preparations, is considered normal—teachers often want me just to tell them what to do and be done with it. I maintain that you cannot fix anything unless you know what is broken, and insist that we have to go through the "moan and groan" part before we can get to the solution part. They do not always agree with me.

Partly because gender is seen as an issue of the past, and because racial/ethnic differences are much higher in teachers' awareness as a major educational problem, I find that building-level and district-level enrollment and achievement data are sometimes not disaggregated by sex. As a result, classroom teachers may be the only ones who are in a position to notice a sex imbalance. If no one at the building or district level knows that girls are underenrolled and underachieving in STEM courses, it is pretty much a sure bet that the problem will not be addressed.

A related fact is that STEM teachers, much like other teachers, administrators, and counselors, are not aware of data on broader gender issues that could illuminate the gender gap for them. When they took their education courses in college or graduate school, gender was in all likelihood barely mentioned or not mentioned at all. Educa-

tion texts rarely mention it (Zittleman & Sadker, 2002), and most teacher educators do not mention it either (Sanders, 2003). A recent review of gender equity coverage in teacher education programs calls it "shallow, superficial, and even inaccurate" (Sadker, Zittleman et al., 2007). Although gender is a major issue for girls in STEM, it tends to be included in STEM methods courses only if the instructor happens to have gender as a particular, and personal, interest. Such people are rather unusual.

Then, there are the longitudinal aspects. Much of what we know about gender has been learned over the past two or three decades in grant-funded research. The major source of funds for research in gender in STEM is a program in the National Science Foundation called Research on Gender in Science and Engineering. This program, in existence since 1993 (under several names), has funded about 440 projects since then. Projects are funded for up to three years, not a very long time. Few other funders support long projects for the same reason, namely, longitudinal projects are expensive. They also tie up program funds, making the program less able to be responsive to changing needs. As a result, our knowledge is skimpy about the long-term effects of what we do.

Teachers, however, think they know. When a few female students majoring in computer science or engineering come back to visit their old high school teacher, the teacher feels she or he has beat the gender odds. The teacher does not stop to think that the young women who never go on in a technical field—or who try, but drop out—are not likely to come back and announce their "failure." It is really true that the plural of anecdote is not evidence.

5. WHAT WE DO NOT KNOW

I do not want to give the impression that we gender equity specialists know all there is to know and that it is the teachers' fault for not shaping up. I just mentioned the dearth of longitudinal studies. Granted, long-term studies are expensive, logistically difficult, and require large samples to take into account the many intervening variables. But without them, we cannot be sure that an intervention at the high school level, much less at the middle school level or below, will in fact have a long-range impact.

We do not know the relative effect of one type of intervention as compared to others. For example, many gender projects have tried role models, teacher training, curriculum changes, mentors, hands-on experiences, summer enrichment programs, and many, many additional interventions. Which work best with girls of different characteristics (age, race/ethnicity, socioeconomic level, and others)? We do not know. The *New Formulas* book referred to above has a 37-page index, large pages in small print, with interventions from activity-based learning to writing (National Science Foundation, 2003). The best we can do now is choose interventions based on guesses that are somewhat informed by the research, but they are still guesses.

We also do not know what makes one university or district or school, or individual teacher for that matter, make big gender equity changes while others with the same interventions do not. This is so whether the educational units are solicited to take part in a gender project or whether they freely choose to apply for one. I am sure I am not

the only person to teach workshops to STEM teachers who all have large gender gaps in their classes, and find that teachers do not respond the same way. More precisely, I see a bell curve, i.e., some teachers do spectacularly well in making changes and report significantly increased female enrollments and test scores, some do nothing at all and have no change, while the majority fall in between. Is this due to signals I am sending without being aware of them? Or is it due to differences in their personal or profession backgrounds that result in hearing me differently? Or to differences in the conditions of their jobs, such that some feel overloaded by other responsibilities while others feel able to take another one on? To personality differences? We do not know. It is commonly thought that to reach an adult on female gender issues, it is best if that adult has daughters. We do not even know if this is true.

Even when well-established programs are out there, heavily publicized and even sought out, why are they not replicated? As many gender equity specialists in technology know, Allan Fisher and Jane Margolis managed to raise the female enrollment in the School of Computer Science at Carnegie Mellon University in Pittsburgh from 8% to 42% in five years. They gave many presentations on what they did at professional meetings and wrote up how they achieved their stunning results in a book for the public as well as the computer science establishment (Margolis & Fisher, 2002). After the publication of their book to wide publicity and acclaim, Jane and Allan did a nationwide book tour, and Allan in particular was invited to speak about it at many schools and colleges of computer science across the United States. Two years after the book was published, I asked him how many of them had begun to replicate his model. "None," he replied (Allan Fisher, personal communication, July 29, 2004). Why, when there is virtually a recipe for gender progress available and when universities are interested enough to pay the costs of inviting an expert to campus to speak about it, is there no action? We do not know.

One thing is clearly our fault. Like the young college women who choose whether or not to visit their high school STEM teachers, we are eager to spread the word of our successes and disinclined to announce our failures. Each of us knows, however, that we probably learn even more from our failures than from our successes, and we also know that failures are unavoidable when we are not sure of all the answers in advance. Nevertheless, we act as if a failure is a personal shame, as opposed to something that can help us and our colleagues learn. One of the best conference sessions I ever organized was one I called "Snatching Defeat from the Jaws of Victory." The panelists I invited to participate were people who had done groundbreaking work in gender and other social justice issues in education. Each of us described a major failure and what we learned from it. Ideally, there should be no need for such a session, i.e., we should present our failures as readily as our successes as a service to our colleagues.

6. WHAT SEEMS TO WORK

I include this section with some trepidation. I have no idea if what works for me works for everyone, and I also know that nothing I have tried works with all teachers. Nev-

ertheless, just as I have learned many things about what tends to discourage STEM teachers from tackling gender equity, I have learned a few things about what seems to make some of them, at least, want to.

As the starting point, I learned long ago that before I even step into the room, teachers who do not consider themselves feminists are defensive because at best they think they are in for a session of politically correct pious platitudes, and at worst that I will blame them for the gender gap, even though they are positive it is not their fault. It is a short step from defensiveness to resentment or even anger. The best I can hope for is skepticism. I always assume it is there, and I have not been wrong about it yet.

As a result, the first thing I have to do is defuse the resentment, because otherwise, they will refuse to learn anything. Most important is to explain and emphasize the universality of gender bias. When we all cannot help learning gender schemas, as Valian (1998) calls them, from our first moments outside the womb—the baby X and early childhood studies are invaluable here—blame makes no sense. When teachers understand that most gender bias takes place inadvertently because it is both sent and received below the level of conscious awareness, they can stop being defensive. After all, what teacher is deliberately biased? And when I tell them that I too am gender biased, and tell them how one teacher pointed out to me that without realizing it I made more eye contact with males than with females, they begin to feel safer in recognizing their own gender bias. At this point, teachers become a little bit willing to listen.

Next, I try to use local data whenever possible. For example, I have lately been working with advanced placement high school teachers of computer science, chemistry, and physics in Dallas and Plano, Texas, projects that were funded by the Women of TI Fund (Texas Instruments)[1] via the Dallas Women's Foundation. The Dallas project started with local data when it was discovered that girls who scored very highly in the math part of the preliminary scholastic aptitude test (PSAT-Math) subsequently failed to score as highly in STEM advanced placement exams, and were therefore significantly less likely to pass the exam and earn college credit (Sanders, Nelson, Brown, Bruhn, Dewar, Jensen et al., 2004). Obviously, these girls' lack of ability was not the issue here. When I showed the data to the teachers, they had to admit that something else had to cause the difference, and were intrigued enough to want to find out what it was. In situations where I cannot get local data, I use national data—but local is preferable by far.

The third thing I try to do whenever possible is to stress the importance of teachers finding out about gender bias for themselves. I tell them that of course I am a feminist, but ideology is not what the workshop is about. After all, if I myself would not just take someone's word for something—"trust me on this," is not a convincing argument!—why should they? One way to do this is to give teachers "mini-assignments" in advance of the workshop in order to check out the gender situation in society. For example, I ask them to analyze gender messages in toy stores, greeting cards for children, children's television shows, children's clothing stores, Web sites for children, computer stores, magazines for teenagers, and so forth. I ask them to do surveys of families with chil-

[1]http://www.ti.com/womenoftifund/

dren to find out who does which household chores and whether the chores are gender stereotyped. Later on in the workshop series, we get to school-based and STEM-specific mini-assignments. It is important for them to see that gender bias is pervasive and systemic, not something occurring only in classrooms. Children do not arrive in the classroom in a bubble. They have had years to be influenced by millions of gender messages, most of them unintentional. This exercise is partly to minimize blame and guilt, but partly to help teachers achieve an accurate understanding of the nature and scope of the gender problem. It also helps to bring them a little further along the path of being willing to consider gender as an explanation of why girls tend to underenroll and underachieve in STEM.

I have found again and again that the hands-on activity that makes the most difference with teachers is to ask them to be observed in their classrooms for gender bias—which, as I remind them ad nauseam, is inadvertent. There is nothing new about teacher-student interactions that vary by sex of student (not by sex of teacher, which always surprises them)—the research has been out there for well over 20 years—but it remains extremely powerful. I give teachers a list of behaviors that have been shown to be significant in terms of gender, such as calling on students, amount of eye contact, body position in relation to students, higher- or lower-order questions, wait time, and many more. I show them how to tally the behavior, and suggest that the observer might be a colleague, a trusted student, or oneself via videotape seen after the class. They choose the behavior to be tallied and the observer to do the tallying. Once teachers do this, they are skeptics no longer. Discovering that you are favoring boys in class, without meaning to and without even realizing you are doing it, has a phenomenal impact.

In the Dallas project, we had a dinner session for the teachers taking the workshops, their principals, and their guidance counselors. From the transcript of the session, one of the teachers, a man in his 30s, said this to the administrators:

> *This project has made more change in our classrooms than just about anything else we've been doing...We want you to give us more opportunities to help other teachers move from the skepticism where all of us honestly started, severe skepticism. I was more than skeptical. I thought it was just more left-wing baloney crap. I really did. (Laughter.) And when I saw the hard data, I was willing to listen, okay? And when I began to actually try things in my classroom and saw the change, I was stunned, I was shocked—I really didn't think it was going to work. The difference is not just tangible; it is overwhelming. I have more than 100% more girls in AP this year than last year. And the difference is in the teaching, in how I treat the girls.*
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> Daniel Brown

Daniel Brown, a Dallas physics teacher, is now giving gender workshops of his own, and he and I have done a couple of projects together. It is a joy when your student becomes your colleague.

There are several other things that I find helpful. One is repeated training sessions as the best form of follow-up. Follow-up is essential because it counteracts the natural

tendency to let gender equity slide to a back burner when other parts of your professional life require more attention, as always happens. Put another way, a single workshop, especially a short one of an hour or two, is pretty much a waste of time. My recent projects have featured four or five sequential workshops over the course of a school year. Before each session participants complete mini-assignments, and at the workshops they discuss their findings plus the changes they have seen in their classrooms and their own teaching behavior since the last workshop. Repeated sessions in particular are valuable because they provide time for teachers to gradually come to their own conclusions—which are much more important for them than my conclusions!—about the role of gender in the classroom and to share them with their peers.

Presenting research on gender is also helpful. Once teachers leave college or graduate school, their continuing education tends to be somewhat less than stimulating. As another of the Dallas teachers put it:

> *It is not often that classroom teachers are made to feel like professionals. Our staff development opportunities are usually geared toward the lowest common denominator and fail to use even a modicum of good teaching practices. This project was different. We were given real data from educational journals, the context in which to understand it, and concrete methods to change our own classroom instruction and get quantifiable results. We were treated as collaborators, instead of people to be lectured at.*
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> Rebecca McGowan Jensen (Sanders et al., 2004)

It is essential, especially at the beginning of a project before teachers become involved, to think quite carefully about the WIIFM rule (pronounced "wiffim"): What's in it for me? We gender equity specialists think all too often that pure virtue and altruism are enough to carry the day, but it is not true. Teachers, above all those in large-city school districts, tend to have heavy teaching loads and full schedules. They are far from convinced that gender equity is important—an understatement there—and should not be blamed for not flocking to volunteer for even more work. Getting teachers in the room, other than those who are already committed to gender equity, is frankly a quandary. I have found that paying them stipends for their time helps, and this is only fair—other professionals are not routinely expected to donate their time for a professional activity. Providing food always helps. If paying them money is not possible, then some other advantage must be found that will appeal to busy and skeptical teachers. It might be continuing education credit, a drawing for a gift certificate or other prize that has been contributed by a donor, positive publicity for their schools, certificates with which to impress their principals, or anything else they consider valuable.

Something that helps with teachers, and that I tell them helps also with their own students, is explicitness. I am aware that the literature contains many references to the importance of modeling the desired behaviors, but I honestly have never found it to be sufficient. Without explicitly pointing out *why* I am doing what I am doing, all the gender-fair good teaching in the world makes little difference. Daniel Brown, one of the Dallas physics teachers mentioned earlier, conducted an unintentional experiment about explicitness:

> *I informed three of my six classes explicitly about the changes I was making in my teaching style and why I was making them. I did not inform the other three classes. I saw much more boldness and confidence from the girls in the classes where the announcement had been made.*
>
> (Sanders et al., 2004)

The girls in the classes where he happened to mention the gender equity project were less likely to tolerate interruptions from boys and more likely to trust their own abilities. Boys, similarly, learned to be less dominating, also a good lesson.

I have also found it essential to vary the activities in a workshop as much as possible, i.e., not just lectures with visual aids and videotapes, but a large variety of participatory activities. This is related to the evaluations I ask people to complete at the end of each workshop, whether or not I will see them again. Over the years, I have honed it down to only three questions, namely, what was most useful, what was least useful, and give the workshop a grade from A to F. In a successful workshop, responses to the first question (what was most useful) are all over the map, with different teachers identifying different components. This is a reflection of the fact that different people learn differently, so it is important to provide a variety of entry points into the topic. If responses to the second question (what was least useful) show a trend, with a significant number of teachers identifying the same aspect of the workshop, then I know I must change that aspect in the future. The last question (grade A to F) is shorthand for myself and for funders about how much teachers liked the workshop. I never forget, however, that liking the workshop is necessary but very far from sufficient to create change. After all, creating changed behavior among the girls is the goal; teacher enrichment, while nice, is not.

Finally, I try to put into practice something I learned years ago from a voice teacher. He never corrected me, never told me I did something wrong or less than well. Rather, he would say, "Okay, now try it this way," or "Good! What would happen if you did this?" or "That's great! Now do this." Over time, I found that I was singing better and enjoying the lessons a lot. He made me feel competent and skilled. I have tried to do with the teachers as he did with me. In fact, I think of my role as that of a coach, guiding them and cheering them on. It is accurate, too: like singers and athletes, it is the teachers who need to put what they are learning into practice.

7. INCREASING PROGRESS

I have had fairly good success with teachers on gender and STEM, once I get them in the door. How do we make teachers more interested in doing something about the gender gap in technology and science? How do we get their administrators to care about it? How do we get more teachers in the door?

One of the answers, alluded to earlier, is that for decades now we in the gender equity business have prided ourselves on the materials we have produced for educators and students, namely, training materials, videotapes, posters, books, booklets, supplementary materials, newsletters, Web sites, and much, much more. Many are excellent. Few are used. A large part of the reason is that when we get our grants to produce

excellent materials, the criterion is how good they will be. While dissemination plans are built into most grants, our dirty little secret is that our real concern is with production, not consumption. As long as the grants keep coming and our names keep getting out there, we have done our job.

But we have not. The reality is that the world is flooded with good gender equity materials in STEM, and relatively few educators use them. We are focusing almost exclusively on supply rather than demand. With little demand, our materials sit crated up in warehouses. The field of gender equity must become much more savvy in marketing. We need to think like Madison Avenue selling toothpaste, i.e., what can we do to increase demand? This is not a comedown for us, but a reality check. There is absolutely no point in developing materials that will not be used, and we are kidding ourselves if we think otherwise.

A reason more people have not been buying what we have been selling, I think, is that nearly all gender equity efforts have been piecemeal, and understandably so. We work with small groups of girls or teachers because we can—because funding is available for small projects, because projects of that scope are doable. We have not been successful in approaching the STEM gender gap, and indeed in approaching any gender gaps, systemically. There are 13,809 relatively autonomous public school districts (National Center for Education Statistics, 2009a), 93,295 public schools (National Center for Education Statistics, 2007a), and 28,996 private schools (National Center for Education Statistics, 2007b). There are 4.7 million teachers, from elementary through postsecondary (National Center for Education Statistics, 2009b). It is simply not possible to achieve widespread action on gender equity piecemeal: there are just too many districts, schools, and teachers out there. We must turn to education systems. There are only two large-scale systems in education in the United States, and both leave something to be desired from a change agent's point of view.

The first is teacher education, if it can even be called a system. There are approximately 1200 colleges and universities in the United States that graduate new teachers and administrators, and they are almost entirely autonomous. However, teacher education is a professional field, and as such it has associations, conferences, journals, and newsletters. Here, we have a chance because there are a manageable number of professional associations serving the field. The two major ones are the American Association of Colleges for Teacher Education and the Association of Teacher Educators. There are three major accrediting organizations (but on the national level, accreditation is voluntary), namely, the National Council for Accreditation of Teacher Education and the Teacher Education Accreditation Council which deal with education programs in colleges and universities, while the National Board for Professional Teaching Standards deals with individual teachers. Teacher education also, like most professional fields, has fads and fashions. Assessment or accountability may be hot issues this year, but not next year. All of these associations have addressed gender equity somewhat, but it has never been a major issue with any of them. It would seem that one route to systemic gender equity influence, then, would be to establish it as a high-profile, hot-button professional issue in one or more of these associations. This is more easily said than done, however.

The second large-scale system unfortunately exists in 50 versions. Each state's department of education performs three essential functions with respect to teachers. It accredits teacher education programs at colleges and universities in the state. It establishes minimum requirements for the certification of new teachers, counselors, and administrators, which all institutions granting degrees in education must enable their education students to meet. States also set requirements for continuing education for teachers, counselors, and administrators. All these functions are codified in state laws and implementing regulations. In some states an assessment instrument that is based on state requirements is used with student teachers and administrators. In Washington State, for example, the assessment instrument is not a state government function, but rather is developed and promoted by the state's teacher education professional association, to which all 22 of the state's education degree–granting institutions belong. Any and all of these functions are susceptible to gender equity influence.

Obviously, influencing an entire profession through its professional associations is not easy or quick. Neither is changing state law. But people created each system, and people can change them.

A second approach that might be helpful is to recognize that we ourselves are far too fragmented. Especially because there are so many districts, schools, and teachers, it makes no sense for specialists in gender equity in STEM to push for their cause alone. Are we competing for attention with people who—rightly—consider gender equity in athletics highly important? And what about the people whose hot-button issue is women's history, or women and art?

We can go further along this path. Gender equity for girls in technology and science is not only a subset of gender equity issues for girls in general, but a subset of gender equity issues for everyone. Girls surely are not the only ones who are harmed by our narrow and increasingly outdated notions of femininity and masculinity. Boys underachieve in reading and writing to a much larger extent than girls underachieve in STEM. Schools are plagued by acts of violence and bullying that are mostly perpetrated by boys. Both problems are best understood and addressed as gender equity issues. Writing and reading are seen by many boys as "sissy," and many boys see violence and related behaviors as ways to prove their masculinity.

And the path leads us farther still. Gender equity in turn is a subset of social justice issues in schools. We cannot say that the problem of a girl who is effectively denied a chance at a technical career is more important than when a black or Hispanic child is effectively denied a good education because of her or his racial/ethnic group. Children with physical and mental disabilities are all too often provided with educations that fail to develop all of their other abilities. Children who live in low-income areas, primarily but not exclusively inner-city and rural areas, are notoriously underserved by the education establishment. So are homeless children. So are children whose parents have deficient educations themselves. In all these cases, children fail to receive educations that stimulate them to achieve to the best of their abilities because of the chance circumstances of their birth.

At the present time, many people are working to improve education for girls, for boys, for children of different ethnicities and races, for children with different physical and mental abilities, and for children of various socioeconomic levels. We do not work together. We do not even know each other. Perhaps by acting together to influence education under the banner of social justice we might achieve more, and sooner, than we do separately.

Education is the best way we have to help the next generation do better in life than their parents did. We have been trying to work harder to influence it, but progress has been frustratingly inadequate. It is time to work smarter.

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